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10/571,288	03/09/2006	Wolfgang Heeb	016906-0473	8171

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EXAMINER	
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ART UNIT	PAPER NUMBER
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.**	**Applicant(s)**	
	10/571,288	HEEB ET AL.	
	Examiner	**Art Unit**	
	Nicholas P. D'Aniello	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 April 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 9-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7 and 9-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/27/2009*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 2, 4, 5, 6, 9, 10, 16-18, 22, 24, 25, 26 and 28 are rejected under 35 U.S.C. 102(b) as anticipated by Werner (US Patent No. 3,844,777 of record) with supporting evidence from Toh et al. ("An investigation of the native oxide of aluminum alloy 7475-T7651 using XPS, AES, TEM, EELS, GDOES and RBS", a newly cited reference a copy of which is included).

As to **claim 1**, Werner teaches a brazing workpiece (taken to be a soldering workpiece as the melting temperature of the filler alloy may be as low as 424ºC, see claim 1 of Werner) comprising: a solder workpiece made from aluminum (column 1 lines 8-9) and an aluminum containing brazing (soldering) filler alloy (column 1 lines 52-59) which is directly applied to the workably thin oxide film (column 2 lines 24-34).

Werner acknowledges the presence of an oxide film on the aluminum workpiece however does not disclose the thickness is greater than 25nm. However, Toh et al. have preformed an investigation on a similar aluminum alloy (both the aluminum alloys of Toh et al. and Werner contain Mg and Zn as principal alloying elements) where the native oxide thickness has been measured to be between 100 and 500 nm (see page 370 - Discussion and Conclusions).

Although Werner does not disclose an oxide thickness (techniques to measure such a small thickness were not available until recently) it is an inherent property of

aluminum alloys to have an oxide thickness greater than 25 nm as disclosed by Toh et al.

Regarding **claims 2 and 16**, Toh et al. disclose aluminum alloys containing zinc and magnesium (such as the alloy of Werner) naturally form oxide layers which are between 100 - 500 nm which anticipate the claimed range.

Regarding **claims 4 and 18**, Werner discloses that the oxide layer is penetrated by the filler alloy allowing contact with the base metal therefore the oxide layer is not continuous and must comprise inhomogeneities such as cracks (column 2, lines 30-34).

Regarding **claim 5**, this claim relates to a product by process limitation which does not limit the scope of this claim (see MPEP 2113), in any event, Werner discloses that the oxide layer is *chemically* treated to make it workably thin (column 2 line 28).

Regarding **claim 6**, Werner discloses cleaning with a water based solution containing HF (column 2 lines 40-42), which is reasonably considered a fluorine (halogen) containing lubricant.

In regard to **claims 9 and 19**, Werner teaches the aluminum may be 6061 which contains magnesium in the amount between 0.8 and 1.2 wt% (see TABLE).

In regard to **independent claim 10**, Werner teaches a process of joining two work pieces, at least one as described in claim 1, joining the work pieces by a brazing process, due to the low melting temperature of the brazing filler alloy of the brazing method this is reasonably considered a soldering process.

Regarding **independent claim 22**, Werner discloses a brazing (soldering) process for joining at least two work pieces to one another comprising:

a. providing a soldering workpiece made from aluminum and/or aluminum compounds (column 1 lines 8-9)

b. increasing a thickness of an oxide layer naturally occurs at the elevated temperature and humidity of industrial environments,

c. the surfaces are prepared by introducing inhomogeneities into the oxide surface by a chemical cleaning process (column 2, lines 20-34), and

d. The parts are then soldered together in a vacuum atmosphere and allowed to cool in an inert atmosphere. (column 2, lines 35-61).

The process of Werner is reasonably considered a soldering process in view of applicant's definition of soldering (page 4, last paragraph of instant specification) which defines standard soldering for aluminum as a joining process with temperatures between 500 and 660ºC; where the soldering alloys (referred to as braze alloys in Werner) have a melting temperature between 424 and 615 ºC (see claim 1 of Werner) the process of Werner is consequently considered a soldering process. The cleaning process of Werner creates inhomogeneities in the oxide layer which allows for a capillary effect (drawn in due to the surface tension of cracks and holes) of the soldering alloy into the oxide film (column 1, lines 19-25).

In regard to **claim 24**, although Werner does not specifically teach the oxide film detaching from the workpiece, however the workpiece and process of Werner are structurally and methodically indistinguishable from the claimed method and therefore it

is reasonably assumed that at least part of the oxide film will fragment and detach from the workpiece during the soldering step.

In regard to **claim 25**, Werner teaches the surfaces are chemically cleaned with a solution of water and hydrofluoric acid (a halogen containing lubricant) to provide a workably thin oxide layer which the filler alloy may penetrate (column 2 lines 39-42) the oxide layer is penetrated by the filler alloy allowing contact with the base metal therefore the oxide layer is not continuous and must comprise inhomogeneities such as cracks.

Regarding **independent claim 26**, Werner discloses the soldering workpiece of claim 1 which is aluminum with an aluminum oxide layer to which a filler is directly applied where the oxide is a sufficient thickness to provide contact between the brazing (soldering) compound and the workpiece underneath the oxide by allowing penetration of the filler alloy (column 2 lines 30-34), therefore the oxide film is not continuous and must have inhomogeneities such as cracks.

Werner acknowledges the presence of an oxide film on the aluminum workpiece however does not disclose the thickness is greater than 25nm. However, Toh et al. have preformed an investigation on a similar aluminum alloy (both the aluminum alloys of Toh et al. and Werner contain Mg and Zn as principal alloying elements) where the native oxide thickness has been measured to be between 100 and 500 nm (see page 370 - Discussion and Conclusions).

Although Werner does not disclose an oxide thickness (techniques to measure such a small thickness were not available until recently) it is an inherent property of

aluminum alloys to have an oxide thickness which is within the range disclosed by Toh et al.

Regarding **claim 28**, Werner discloses that the oxide layer is penetrated by the filler alloy allowing contact with the base metal therefore the oxide layer is not continuous and must comprise inhomogeneities such as cracks (column 2, lines 30-34).

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1, 2, 4, 5, 6, 9, 10, 16-18, 26 and 29 are rejected under 35 U.S.C. 103(a) as obvious over Werner (US Patent No. 3,844,777 of record) in view of Toh et al. ("An investigation of the native oxide of aluminum alloy 7475-T7651 using XPS, AES, TEM, EELS, GDOES and RBS", a newly cited reference a copy of which is included).

As to **claim 1**, Werner teaches a brazing workpiece (taken to be a soldering workpiece as the melting temperature of the filler alloy may be as low as 424ºC, see claim 1 of Werner) comprising: a solder workpiece made from aluminum (column 1 lines 8-9) and an aluminum containing brazing (soldering) filler alloy (column 1 lines 52-59) which is directly applied to the workably thin oxide film (column 2 lines 24-34).

Werner acknowledges the presence of an oxide film on the aluminum workpiece however does not disclose the thickness is greater than 25 nm. However, Toh et al. teaches a similar aluminum alloy which has high strength and superior toughness (see

page 366 - 2.1.*The alloy sample*) which has a native oxide thickness between 100 and 500 nm (see page 370 - Discussion and Conclusions).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum alloy of Toh et al. for the soldering workpiece of Werner in order to create a workpiece with superior properties as taught by Toh et al., such an alloy inherently has an oxide thickness greater than 25 nm.

Regarding **claims 2, 16 and 17**, as noted above, the alloy of Toh et al. naturally forms an oxide layer which is between 100 - 500 nm.

Regarding **claims 4 and 18**, Werner discloses that the oxide layer is penetrated by the filler alloy allowing contact with the base metal therefore the oxide layer is not continuous and must comprise inhomogeneities such as cracks (column 2, lines 30-34).

Regarding **claim 5**, this claim relates to a product by process limitation which does not limit the scope of this claim (see MPEP 2113), in any event, Werner discloses that the oxide layer is *chemically* treated to make it workably thin (column 2 line 28).

Regarding **claim 6**, Werner discloses cleaning with a water based solution containing HF (column 2 lines 40-42), which is reasonably considered a fluorine (halogen) containing lubricant.

In regard to **claims 9 and 19**, Werner teaches the aluminum may be 6061 which contains magnesium in the amount between 0.8 and 1.2 wt% (see TABLE).

In regard to **independent claim 10**, Werner teaches a process of joining two work pieces, at least one as described in claim 1, joining the work pieces by a brazing

process, due to the low melting temperature of the brazing filler alloy of the brazing method this is reasonably considered a soldering process.

Regarding **independent claim 26**, Werner discloses the soldering workpiece of claim 1 which is aluminum with an aluminum oxide layer to which a filler is directly applied where the oxide is a sufficient thickness to provide contact between the brazing (soldering) compound and the workpiece underneath the oxide by allowing penetration of the filler alloy (column 2 lines 30-34), therefore the oxide film is not continuous and must have inhomogeneities such as cracks.

Werner acknowledges the presence of an oxide film on the aluminum workpiece however does not disclose the thickness is greater than 25nm. However, Toh et al. teaches a similar aluminum alloy which has high strength and superior toughness (see page 366 - 2.1.*The alloy sample*) which has a native oxide thickness between 100 and 500 nm (see page 370 - Discussion and Conclusions).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum alloy of Toh et al. for the soldering workpiece of Werner in order to create a workpiece with superior properties as taught by Toh et al., such an alloy inherently has an oxide thickness greater than 25 nm.

Regarding **claim 29**, as noted above, Toh et al. teaches the aluminum alloy inherently has an oxide layer which substantially overlaps the claimed range.

5. Claim 17 is rejected under35 U.S.C. 103(a) as being unpatentable over Werner and Toh et al. as applied to claim 1.

Although Werner do not disclose an oxide thickness Toh et al. disclose aluminum alloys containing zinc and magnesium naturally form oxide layers which are between 100 - 500 nm which substantially overlap the claimed range.

6. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Werner and Toh et al. as applied to claim 1 above, and further in view of McMillan et al. (US Patent No. 3,986,897, of record).

Werner teaches a soldering work piece with solder directly applied to an oxide layer as applied to claim 1 above. **Claim 3** differs from the reference in calling for the oxide/hydroxide layer to be predominantly boehmite. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the aluminum oxide layer in a hydrated boehmite form because McMillan et al. discloses the treatment of aluminum by converting aluminum oxide to boehmite in order to achieve an aluminum substrate with a smoother less hillocked surface which also avoids pitting, electro-migration and has improved thermal properties (column 1, lines 43-50 and column 2, lines 52-62).

7. Claims 7, 11, 12, 13, 15 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werner and Toh et al. as applied to claim 1 or 10 above, and further in view of Swaney (US Patent No. 3,747,199, of record).

Werner teaches a soldering work piece with an oxide layer thicker then the native oxide layer as applied to claim 1. **Claim 7** differs from the reference in calling for a

particular lubricant. However, it would have been obvious in the art to provide the soldering work piece with a lubricant containing sulfur because Swaney teaches a method of brazing (soldering) aluminum articles which have been provided with a petroleum based lubricant, Cindol 3401, which contains bromine (halogen) and sulfur compounds which provides for successful brazing of the components (column 2, lines 23-27).

In regard to **claims 11, 12 and 20**, Swaney teaches a method of successfully vacuum brazing aluminum articles as applied above where the workpiece has been cold worked by a pressing (punching) operation (column 1, lines 36-48). It would have been obvious to one of ordinary skill in the art at the time of the invention to machine the workpiece to the desired dimensions and use a halogen and sulfur compound containing lubricant in the method of Werner to successfully form a brazed article as taught by Swaney.

In regard to **claim 13**, it would have been obvious in the art that the thermal degreasing and soldering would be carried out together because Swaney teaches a single heating operation where the lubricants are volatilized (evaporated, thermal degreasing) and then the temperature is increased to effectuate the braze (column 2, lines 28-47).

In regard to **claim 15**, Swaney teaches an example of his invention is for the fabrication of a typical aluminum brazed heat exchanger (column 1, lines 36-44).

8. Claims 14 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werner as applied to claim 10 above, and further in view of Knepper et al. (USP 5,618,357)

In regard to **claims 14 and 21**, Werner discloses the aluminum joining method of claim 10 where the heating is carried out in a vacuum (column 2 line 50). Claims 14 and 21 differ from the reference in calling for the heating to be carried out in an inert gas atmosphere such as argon. However, Knepper et al. teaches the joining of aluminum components by a soldering process which can take place in an inert/protective gas atmosphere or in a vacuum (column 1 lines 35-40) where an inert/protective gas such as argon is used (column 3, lines 34-37).

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a shielding gas such as argon in the process of Werner because inert (shielding) gasses and vacuum processing are art recognized alternatives for aluminum joining as exemplified by Knepper et al.

9. Claims 23, 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werner (US Patent No. 3,844,777) as applied to claim 22 above, and further in view of Orecchia (USP 3,666,869).

Werner teaches the aluminum soldering method or workpiece as applied above where a *thin oxide film* is formed on the surface of a workpiece. **Claims 23, 27 and 29** differ from the reference in calling for the aluminum oxide layer to be 25 nm to 1000nm where the reference is silent regarding the thickness.

However, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the oxide thickness be at least 25 nm (after the components have been soldered) because Orecchia teaches that aluminum components form *thin oxide films* **up to** four tenths a millimeter (400,000 nm) in thickness when exposed to air and elevated temperatures (column 2, lines 40-55) and such a thickness naturally passivates the surface of the workpiece. “Up to” this relatively large thickness is taken to encompass the claimed range and the optimum value would be discovered through routine skill in the art (see MPEP 2144.05 - Obviousness of Ranges).

Response to Arguments

Applicant's arguments have been fully considered but they are not persuasive. Specifically, in regard to claim 1, such an oxide thickness is taken to be inherent in view of the disclosure of Toh et al. Although Werner teaches the oxide film has to be “sufficiently thin” an oxide film on the order of **nanometers** is well within the range of the normal meaning of **thin** and within the scope of Werner's disclosure.

In regard to the combination with Swaney et al., similar to the operation of Werner, although the process is referred to as a brazing process, the temperatures used in the operation are within the range described for soldering in applicant's own specification (300 to 500 degree Fahrenheit see column 1 line 55 of Swaney and page four final paragraph of instant specification) therefore the terms soldering and brazing are merely semantic.

In regard to claim 22, applicant argues that the increasing the oxide thickness must be separate from the providing of the workpiece; however, the claim does not preclude the “increasing a thickness d of an oxide…” from occurring simultaneously during the providing of the workpiece. Therefore the rejection stands as previously presented because an oxide film will naturally form on the work piece which anticipates the increasing an oxide thickness step as the oxide in Werner is sufficient to provide contact between the soldering compound and the workpiece underneath the oxide during the soldering process.

In regard to claim 23, the rejection is not modifying the soldering process of Werner; Orecchia is used to show that it would have been obvious to increase the thickness of the oxide layer in the finished product after the soldering operation has been completed in order to passivate the surface of the component. It is further noted that the aluminum workpiece of Werner would **inherently have an oxide thickness greater than 25 nm** as evidenced by Toh et al. as applied in the rejection of the other independent claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Inquiries

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas P. D'Aniello whose telephone number is (571)270-3635. The examiner can normally be reached on Monday through Thursday from 8am to 5pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571) 272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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/N. P. D./
Examiner, Art Unit 1793

/Jessica L. Ward/
Supervisory Patent Examiner, Art Unit 1793